Triangle side-splitting theorem

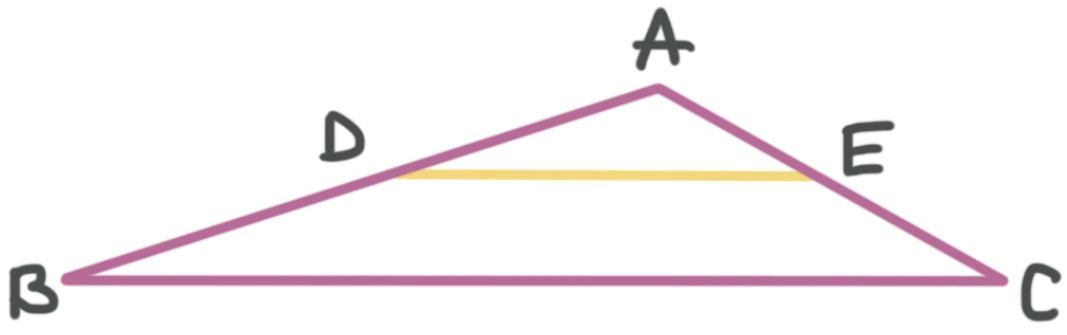
In this lesson we'll look at the triangle side splitting theorem and how it relates to solving for missing pieces of information in the triangles.

Triangle side-splitting theorem

A triangle can be split by a line segment at any spot in the triangle. As long as the segment touches two sides of the triangle, and is parallel to the side it doesn't touch, then the segment splits the triangle proportionally.

In the triangle below, the segment DE is parallel to BC, $DE \parallel BC$. Because the segment divides the triangle proportionally,

$$\frac{AD}{DB} = \frac{AE}{EC}$$



Let's start by working through an example of how to solve for parts of a triangle using a segment that's splitting the triangle.

Example

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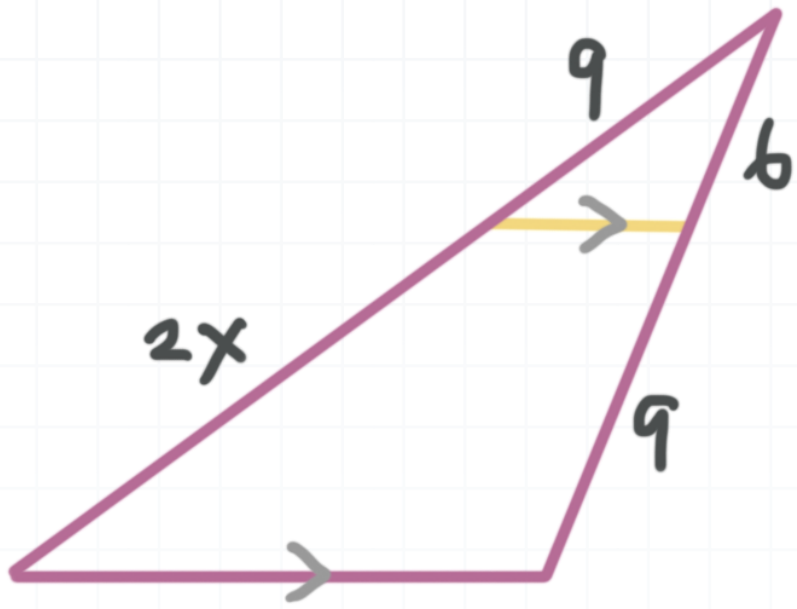
In the figure, the triangle is being split by a segment. Solve for x.



The parallel lines mean that we can use the triangle side-splitting theorem to solve for the variable.

The ratio $9/2x$ has to be equal to $6/9$.

$$\frac{9}{2x} = \frac{6}{9}$$

$$9(9) = 6(2x)$$

$$81 = 12x$$

$$6.75 = x$$

Let's try another one.

Example

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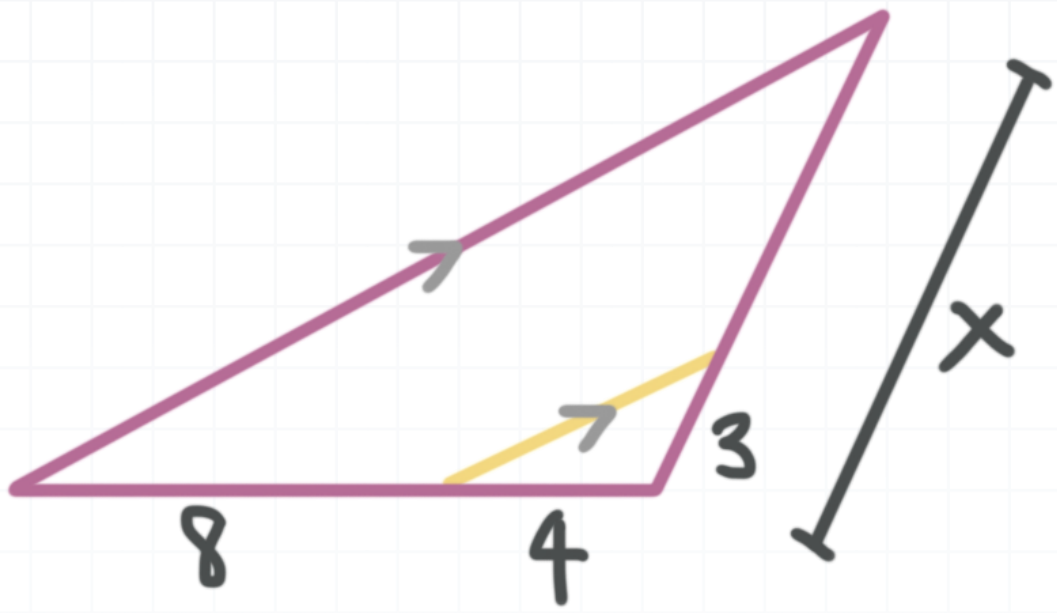
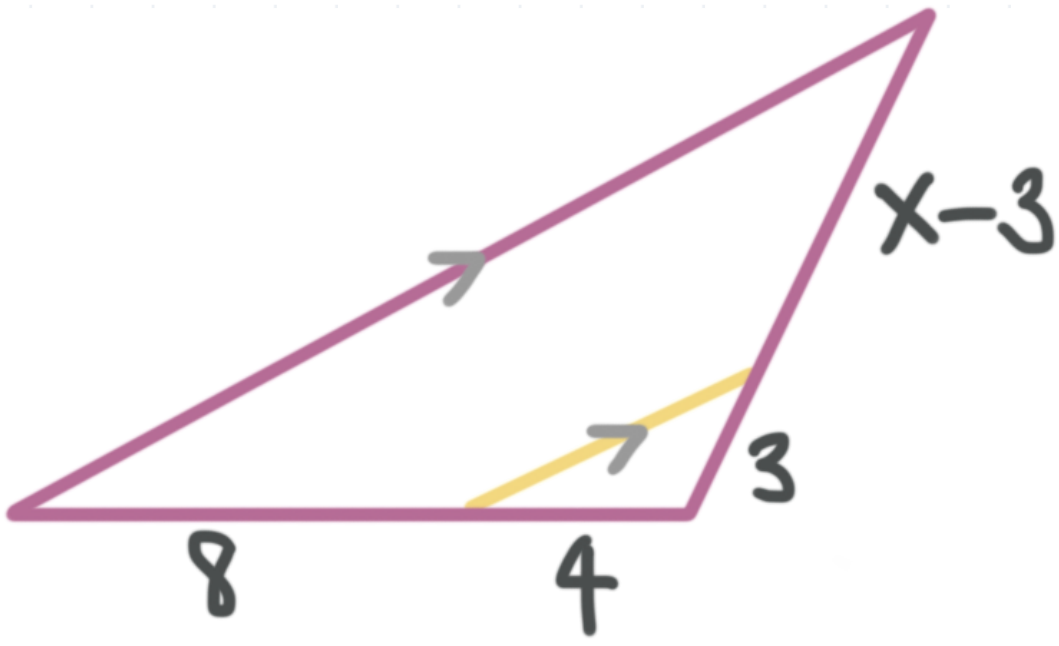
In the figure, the triangle is being split by a segment. Solve for x.



The parallel lines mean that we can use the triangle side-splitting theorem to solve for the variable. We know the length of one side of the larger triangle is x, and that the side length of the smaller triangle along the same side is 3. That means the length of that side of the triangle *outside* of the smaller triangle is $x - 3$.



The ratio $3/(x - 3)$ has to be equal to $4/8$.

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$$\frac{3}{x-3}=\frac{4}{8}$$

$$8(3)=4(x-3)$$

$$24=4x-12$$

$$36=4x$$

$$9=x$$

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